What is Traffic Engineering?

THE present world conflict has necessitated broadened conceptions of many of our well-established peacetime activities. This is particularly true of our profession—Traffic Engineering. Basically traffic engineering is the science of providing and maintaining adequate methods for the efficient and safe movement of persons and property, over streets and highways.

During the past several decades, since the development of the automobile, the traffic engineering profession as we have come to know it, was created. As the output of automobiles increased and the ultimate supply seemed unlimited, it was natural for the traffic engineer to apply himself largely to the physical control of traffic units on the highway in an effort to provide for the most effective flow of these units.

With the stoppage of automobile manufacture, the shutting off of a large portion of our rubber supply, and the rationing of gasoline, the need of attention to another phase of the basic science of traffic engineering became apparent. This phase of the science includes the more efficient utilization of transportation units by increasing the per unit loading, by leveling off the peaks of transportation requirements, and by other effective means.

Accordingly, it is recognized that the profession of traffic engineering is not confined to the installation and maintenance of signs, signals, markings, traffic lanes, etc., but includes such subjects as staggered hours, group riding, route scheduling, terminal and parking facilities, etc.—in short methods of utilizing effectively the diminishing supply of transportation units.

Today as never before, the traffic engineer should recognize his responsibility to aid in creating a wide public appreciation of the broad basic factors included in the science of traffic engineering. He can help accomplish this aim through his writings, addresses and daily contacts but of most importance, through his ability to apply himself to the present increasingly important phase of traffic engineering which deals with transportation conservation.

W. Graham Cole
Secretary-Treasurer, I.T.E.

VOLUME XIII NOVEMBER, 1942 NUMBER 2

IN RECOGNITION OF

A VERY pleasing and acceptable recognition of the wartime traffic efforts of members of the Institute of Traffic Engineers was the grant of $5,000 made recently by Yale University to the Institute from the Eno Foundation Fund.

In his letter to the Institute, President Charles Seymour of Yale University wrote, "Needless to say, we are the happier at being able thus to cooperate with the Institute of Traffic Engineers, as a result of the cooperation of The Eno Foundation with us, because of the opportunity afforded to us to recognize by this grant the distinguished public service rendered for so many years in the field of Highway Traffic Control by William Phelps Eno, B.A. 1882, the founder of The Eno Foundation for Highway Traffic Control, Inc., and an Honorary Member of the Institute of Traffic Engineers."

The Board of Direction of the Institute of Traffic Engineers at its meeting in Chicago on October 4th, accepted the grant and decided that the funds would be utilized for the conduct of a research and field evaluation study of "How to Solve the Emergency Highway Transportation Problem of War Plants." A board of trustees consisting of D. Grant Mickle, Chairman, Harold F. Hammond, Thomas J. Seburn, and W. Graham Cole, Secretary, was created by the Board of Direction to administer the funds.

After proper consultation with President Seymour of Yale University and with the approval of Dr. Miller McClintock (Mem. I.T.E.), Director, Bureau for Traffic Research, Yale University, Mr. T. M. Matson (Mem. I.T.E.), Research Assistant of the Yale Bureau, was granted a four months leave of absence to serve as Project Director for the Institute of Traffic Engineers.

At a special meeting of the trustees held in New York, November 22nd, with the Project Director, it was decided that the activities made possible by the Yale grant would be conducted under the name "War Transportation Project" and that special emphasis would be given to the transportation problems of war plants. To aid in planning and conducting the project, the Institute will be asked to appoint a technical advisory committee of Institute members. In addition, all members will be given an opportunity to submit case examples of methods used to solve plant transportation problems with which they are familiar.

Every member of the Institute should accept the responsibility and opportunity afforded by the Yale grant to demonstrate an increased service to the country and to the more efficient movement of traffic.

MILEAGE-RATIONING

AT 12:01 A. M. December 1, 1942 Mileage-Rationing goes into action in an effort to obtain the maximum of passenger and property mileage with a minimum of rubber mileage.

In the Preamble to the tire rules it is stated that the eligibility of passenger cars for tires has been broadened and is based on essential mileage allotted to each car under a system of nation-wide gasoline rationing to conserve rubber.

Many "A" basic gasoline ration

holders who now have 150 miles of occupational and 90 miles of other essential driving each month but who do not drive their cars to and from work will probably have units removed from their "A" basic coupon books.

Every basic ration holder is to have his tires inspected periodically. Since each local War Price and Rationing Board must know somewhat in advance the expected demand for rubber mileage, it is likely that the tire inspector will send the motorist to his local Board to make application for tire replacement some months in advance of the point when further mileage would abuse the life of the tire.

The local Board will examine the average monthly occupational mileage driven by the "A" basic ration holder and will remove from the basic ration coupon book issued to the applicant one coupon for each full thirty (30) miles per month by which the total mileage driven in such vehicle for occupational mileage, medical attention, therapeutic treatment, to procure necessary food or supplies is less than 150 miles a month and for which no adequate alternative means of transportation are available.

Every car owner should limit the use of his car to the most essential purposes, even though he receives only 90 miles of driving or 6 to 8 gallons of gasoline a month.

The Preamble to the tire regulations concludes, "There is no assurance that the rubber supply will be sufficient to cover even the most essential needs, and further restrictions may be necessary in the future."

In the words of the Baruch Committee's report, "We have the choice: discomfort or defeat. There is no middle course."

Each applicant of a basic gas ration must record the serial number of all tires mounted on his vehicle and must turn in all passenger-type tires over the five tires allotted each passenger automobile.

The applicant for supplemental gasoline rations must first establish his monthly occupational mileage which is defined as mileage driven by a person in carrying on an occupation (business, gainful work) or to and from a place where such occupation is carried on.

No mileage will be allowed, however, unless the applicant establishes either:

1. That a *"bona fide"* ride-sharing arrangement has been made pursuant to which at least four persons (including the operator) will regularly be carried in the vehicle for the purpose of going to and from or carrying on their *occupations: Provided,* that each person must certify to his participation in the ride-sharing arrangement by signing the application; (Persons mean any individual).

2. That no such ride-sharing arrangement could reasonably be made but that the vehicle carries *as many persons as could reasonably be expected* in the light of the circumstances in which and the purpose for which it is used; that transportation is needed for such purpose; and *that no alternative means of transportation are available* which would be reasonably adequate for such purpose.

(i.) An applicant may establish that four or more persons cannot regularly be carried in the vehicle for which application is made by showing: the limited capacity of the vehicle; the absence of a fixed place of work; the necessity of traveling at unusual or irregular hours; the necessity of traveling over routes not feasible for other persons who might be carried; or such other reasons as the Board may find sufficient.

(ii.) An applicant may establish the lack of reasonably adequate alternative means of transportation by showing

the unavailability of other public or private means of transportation; or by showing that such alternative means, if available, are inadequate by reason of location, schedules or overcrowded conditions, by reason of the nature of the work for which transportation is needed, or for such other reasons as the Board may find sufficient.

(The regulations do not mention trolleys, trolley buses, or buses in connection with the availability and adequacy of alternative means of transportation. It is presumed such services are alternative means of transportation and some standards of distance from home to transportation line and from transportation line to place of employment together with a maximum overall time from home to place of employment are being set forth.)

3. In the event the applicant or principal user is employed at a power generation or transmission facility, public utility, transportation or communication facility, or agricultural, extractive, *industrial*, military, or naval establishment at which more than one hundred (100) persons are employed, the application, if made for a ration to be used for transporting such applicant or principal user to and from such place of employment, must if four (4) or more persons are not regularly carried in connection with their occupations, be certified as indicated thereon by the official in charge of an Organized Transportation Plan at such establishment.

(Other concerns with more than 100 employees are not included but Local War Price and Rationing Boards have in the past honored the certification by the official in charge of the firm's Organized Transportation Plan.)

Suspension and revocation of rations can apparently be made by O.P.A. in the event the motorist is convicted of exceeding the 35 miles per hour speed limit, he blends gasoline to produce more mileage than that granted by the local Board, and abuses or neglects his tires. In fact, no person owning or controlling any motor vehicle shall use or permit the use of gasoline therein for operations in violation of any order, rule or regulation by the Office of Defense Transportation.

(Excerpts from O.P.A. Ration Orders No. 1A and 5C with comments by the Editor.)

HOW TO ORGANIZE AND OPERATE A RIDES BUREAU

By

D. M. McCracken & L. Williams

1. Announce the plan to establish a Rides Bureau for employees. The official announcement distributed to all employees or posted on the bulletin board should be signed by the management. Employee magazines or news bulletins should headline the plan. Special posters will help gain employee cooperation. Releases should cover the purpose of the Rides Bureau, how it will operate, benefits to employees and importance to the war effort.

2. Display Rides Bureau maps, broken down into half-mile squares and keyed by letters and numbers, in places convenient to employees three to five days before questionnaires are distributed.

3. Distribute a questionnaire to each employee. On this questionnaire employee tells his present method of transportation, requests the Rides Bureau to assist him in joining or forming a share-ride group and indicates the Map Square in

which he lives by letter and number.

4. Collect completed questionnaire from employees. Sort by Map Squares. (Example: A1, A2, A3, etc.) Sort those employees living outside the Rides Bureau map by name of town and subdivide towns by residential district if necessary. Place the sorted questionnaires for each Map Square or town in separate folders, label the folders, and file in alphabetical order.
5. Arrange employees in each folder according to shifts. Separate and arrange in alphabetical order those who ride or drive to work in automobiles from those coming by other means. If there are more than 7,500 employees, it has been found helpful to sort the questionnaires by shifts and then by ordinate squares. Each shift then forms a separate section of the file.
6. Draw from the map square folders (starting with section folders "A1", first shift) the questionnaires filled out by "drivers". Check the names listed to see how many empty seats are available. Add other employees according to their desires expressed in the "Request for Transportation Aid" section of the questionnaire. Make every effort to match drivers with drivers and to fill cars to capacity.
7. When a group is formed, fill out Club Number Forms in duplicate with names, addresses, etc., of all members of each riding group, keeping the original in a numerical file in the Rides Bureau and sending the copy to the principal driver, asking him to make final arrangements with the other members of the group.
8. Record the Club number in the upper right hand corner of each member's questionnaire and return to its proper place in the proper shift and folder.
9. Follow this same procedure until no more drivers or riders can be added to existing riding clubs, then match together all remaining drivers and riders not yet placed in share-the-ride groups and follow the same procedure as in 7 and 8.
10. Principal drivers are to report back to the Rides Bureau what arrangements they have been able to make. The Club Number Form is then adjusted accordingly in the Rides Bureau file. If too many empty seats are still left in a group, the principal driver is given other names to contact in place of those who couldn't join.
11. *Maintenance Procedure*—Once this system has been established, the following procedure can then be carried out in maintaining service to employees:
    a. *New Employees* — When the questionnaire of a new employee is received at the Rides Bureau, the attendant notes the map square number on the form and goes to that folder in the questionnaire file where he finds the questionnaires of other employees who live closest to the new man. Using the Club numbers on these, he then looks up on his Share-Ride Club list the makeup of those particular Clubs and fits the new employee into the one which is best suited to his needs and has available space for him. The *new man* is then given the name, address and phone number of the Principal Driver in that Club and instructed to contact him stating he would like to participate in that Share-Ride group. If he is successful in making the arrangements, the Principal Driver then reports back to the Rides Bureau, and the new man's name is added to the Club. If he is unsuccessful, the new man so

informs the Rides Bureau and another Club is tried.

b. *Terminations*—When the name and address of an employee is received by the Rides Bureau signifying that he has left the company, the attendant looks up the address on his key map to find the map square in which he lives. The attendant then goes to that folder in the questionnaire file, pulls out the ex-employee's questionnaire and gets his Club number from the upper right-hand corner. The employee's name is then deleted from the Share-Ride Club list, leaving space for a new member in that Club. The old questionnaire is then sent to the local ration board, or placed in a folder of ex-employees if it is desired to retain such questionnaires for a definite period following the termination date.

Important—It will be seen from the first sentence in the above paragraph that it is necessary to give the Rides Bureau not only the name but also the address of employees leaving the company.

c. *Change of Address or Change of Shift*—If an employee moves into a different part of town or changes shift and notifies the Rides Bureau of his need for a change in transportation arrangements, he is treated first of all as a new employee and the "New Employee" procedure is followed to match him up in a Share-Ride Club in his new neighborhood. Next, the "Terminations" procedure is followed in removing his name from his former Club. Finally, the new Club number is placed on his questionnaire which is then filed according to his new location in the questionnaire file.

12. *Certifying Applications for Extra Gasoline or Tires:* Rides Bureau attendant finds employee's questionnaire and compares names on employee's questionnaire and on Club's Number Form before Plant Transportation Officer certifies. In this way certifying of employee ration applications can be made according to an organized transportation plan and the local War Price and Rationing Board will honor the Plant Transportation Officer's signature and the employee's application is facilitated.

Car-Sharing Procedure prepared for Providence industrial and business concerns by Dwight M. McCracken, Director Traffic and Safety Bureau, Liberty Mutual Eng. Co., and Leslie Williams, Director, Civic Planning & Traffic Board, Providence, R. I.

PROMOTING CAR-SHARING

THE National Traffic Advisory Committee to the War Department, the Office of Price Administration, the Office of Civilian Defense and the United States Department of Agriculture have joined forces to promote group riding in connection with the new mileage-rationing regulations which will become effective December 1st.

A digest of the communications from each of these departments to their various state and local agencies is presented here for members of the Institute of Traffic Engineers.

Under the mileage-rationing regulations no employee in an industrial plant employing 100 or more workers may receive supplementary gasoline rations unless a Plant Transportation

Committee has been established to certify that the employee is a member of a ride-sharing group wherever possible. Ride-sharing groups must also be formed by other individuals wishing supplementary gasoline rations. Applications from such individuals will be passed upon by an advisory transportation panel at the local War Price and Rationing Board.

The leadership in promoting ride-sharing is to be taken by the following:

Local War Price and Rationing Boards should urge the local Civilian Defense Council to encourage the formation of ride-sharing groups throughout the community on a block by block basis, and will themselves establish an advisory transportation panel of the local War Price and Rationing Board to pass on applications of such individuals.

The Highway Traffic Advisory Committee to the War Department, through its State Highway Traffic Advisory Committees and local War Transportation Committees. These latter committees are generally headed by a local Transportation Administrator, appointed at the suggestion of the Office of Defense Transportation.

A primary responsibility of the State Highway Traffic Advisory Committee and the Local Transportation Administrators will be to urge upon the management and employees of industrial plants employing 100 or more workers the necessity for establishing Plant Transportation Committees to certify that the group-riding requirements of the rationing regulations are being met. The State Committees and Local Administrators will also be expected to join their efforts in other ways with those of the State and local groups affiliated with other Federal agencies to the end that the arrangements necessary for a successful accomplishment of mileage-rationing objectives may be obtained.

The Office of Civilian Defense will aid plants through its local Defense Councils. Since no one may receive supplemental gasoline in most plants employing 100 or more unless certified by an organized plant transportation committee, it is important that steps be taken at once to have such committees formed.

The United States Department of Agriculture has established through its War Boards, State and county transportation committees to deal with transportation. The county War Board has as its chairman the chairman of the county Agricultural Adjustment Administration Committee. In rural areas these committees may be expected to aid in the promotion of car-sharing.

Local Civilian Defense Councils are requested to:

Get a member of the local War Price and Rationing Board to explain the gasoline and rubber rules and regulations as they affect car-sharing clubs.

Get the local Transportation Administrator to explain the technical information required in forming car-sharing clubs; have him explain the relationship of car-sharing clubs to the total transportation problem of the community; get information and plans from him on the formation of car-sharing clubs at industrial plants, apartment houses, business establishments, etc.; have him explain how "staggered hours" tie in with car-sharing clubs, etc.

Develop a comprehensive and continuing publicity campaign on the formation of car-sharing clubs; use the speaker's bureau, information center and all other media available such as radio and press; use of the materials which will be supplied by the Office of War Information.

In addition to the campaign to create car-sharing clubs in plants, make a house to house canvass through the Block Plan of the defense council.

Use the volunteer office as a source of all volunteer aid such as messengers, typists, card file clerks, telephone aids in forming car-clubs, block leaders, etc.

All agencies urge coordination of efforts to avoid confusion and conflict.

EDITOR'S NOTE—In the East some Local Transportation Administrators will have difficulty with those firms not *industrial* plants with 100 or more employees when trying to get management to appoint a Transportation Committee to organize and operate a sound car-sharing plan These firms will claim they are not included in the regulations.

The firms that now have Transportation Committees but not an organized plan will be reluctant to take the trouble to put one into effect and those that do have plans will be wondering whether the local Price and Rationing Boards will honor their certification.

Ride-sharing among retail counter clerks seems as important to tire conservation as ride-sharing among telephone operators, and *all* firms employing 100 or more workers should have an organized transportation plan in effect.

In one Eastern City there are 183 firms including large department stores with 100 or more employees. All have Transportation Committees which have been certifying supplementary gasoline rationing application of their employees. To date 125 have an organized transport plan in effect. There are also 167 firms with 25-100 employees who also have someone designated to deal with employee transport problems. Some have organized transport plans. Why stop at *industrial* plants with 100 or more employees?

WHAT OF GROUP-DRIVER LIABILITY?

DOES group riding expose the driver to extra financial hazard under the liability laws?

Washington officials say it does not. While neither government executives nor insurance groups wish to be quoted directly, they point out that it is fundamental in the common law that a guest passenger in an automobile cannot recover from the driver for injuries sustained in an accident unless negligence, willful or wanton misconduct, or drunkenness on the driver's part can be proved.

In 28 states, in fact, action against the driver is specifically barred by law except in cases involving some form of gross negligence. The 28 states are: Alabama, Arkansas, California, Colorado, Delaware, Florida, Idaho, Illinois, Indiana, Iowa, Kansas, Kentucky, Michigan, Montana, Nebraska, Nevada, New Mexico, North Dakota, Ohio, Oregon, South Carolina, South Dakota, Texas, Utah, Vermont, Virginia, Washington, and Wyoming.

Not Drivers-For-Hire

The driver would not be relieved of responsibility, of course, if he were operating a carrier-for-hire. But bona fide group drivers are not regarded as operators of public passenger vehicles. Officials admit that some drivers might be so classified under an extra-stringent interpretation of certain state laws, but only then in instances when an exchange of money takes place among ride-swappers. And no such interpretation has as yet been drawn, nor is it likely to be.

As a matter of fact, state motor vehicle administrators, state highway officials, state police chiefs, and most local officials are doing everything in their power to *promote* group driving. They are heartily committed to its support through their affiliation with the system of local War Transportation Committees (of which 600 now exist) and State Highway Traffic Advisory Committees set up under the National Highway Traffic Advisory Committee to the War Department to implement ODT's program for the conservation of transportation. Finally, the protest which might possibly come in peacetime from commercial operators of public vehicles has naturally been stilled by the war emergency.

An Advantage Seen

Off the record, one Washington official expresses belief that guest passengers are likely to prove an actual advantage to the driver in most cases of accident. He points out that the guest is potentially a witness in the driver's favor if a collision occurs.

At all events, neither the liability nor the licensing question has been a factor in group riding to date. A WPB study of group riding projects undertaken by War Production labor-management committees revealed only one instance in which the liability question was even discussed as a possible obstacle.

(An excerpt from a report from Factory Management & Maintenance, Sept., 1942.)

AN EXPERT LOOKS AT TIRES

By

RUFUS G. JASPER

NEGLECT and abuse, combined with innocent waste, are destroying hundreds of tons of irreplacable rubber on the tires now in use on the passenger vehicles and trucks in this country.

This serious charge is supported by facts—facts gathered on the streets and highways of four states, Illinois, Indiana, Iowa and Utah—where more than 21,000 passenger car tires were observed.

It was discovered in the Rock Island Arsenal area study of war workers' tires that one car in four had at least one tire with the tread worn smooth, one car in eight had at least two tires with the tread worn smooth and one in twenty with three tires in that condition.

In the Utah study of war workers' tires, it was found that approximately two cars out of every four observed had at least one tire tread worn smooth, one car in four had at least two tires with treads worn smooth and one in ten with three tires in that condition. It is interesting to note that the tire conditions in Utah were found to be twice as serious as the Rock Island area study showed.

Of 7,004 war workers' tires in Utah observed 64% had the tread intact, 15% were nearly smooth, 18% were smooth and 3% had the fabric showing. In the Rock Island area, these percentages were found to be (for 5,823 war workers' tires) 69%, 19%, 11% and 1% respectively.

Checks of tires on cars in non-war industry areas in Illinois and Utah showed slightly better conditions, indicating paradoxically that war workers who have the greater need for good rubber, have the poorer tires. While non-war workers' tires in Evanston, Illinois, were smooth or showing fabric in 10% of the cases, 12% of the war workers' tires in the Rock Island area were in this category. Utah non-war workers' tires were smooth or showing fabric in 18% of the cases, while war workers' tires here had 21% in this condition.

Cars with two or more smooth tires soon will no longer be usable unless their owners are eligible for retreading, recapping or new tires, or unless their mileage is reduced drastically by a swap-the-ride or some other mileage reduction plan.

The nation-wide reduction in mileage through gasoline rationing will postpone the removal of these cars for a short while, but the days of their active life are numbered.

In the early days of motoring, nearly every driver had his own tire pump, and checked the tire pressure with his own gauge before each trip. He would even look at each tire, and perhaps

kick one or two of them slightly with his shoe as he stopped beside the road to cool the motor or refill the radiator. Today, however, the average motorist depends on the mechanic or service man at the filling station to check his tires and to inflate them to proper pressure.

But even when this is done it is difficult to maintain exactly the correct air pressure because of the wide variation in readings shown on different tire gauges. For example, three gauges at one service station were checked against each other by taking the pressure of the same tire. One gauge read 27, another 32 and the third, 35 pounds. In tests at other stations it was found that many gauges were more than 10% in error.

Spare tires often are neglected until a puncture or blow-out requires their use. In about one car in six it was found that the spare was completely flat or inflated with less than 10 pounds of pressure—not enough to carry a car full of war workers to their jobs if they had to depend on the spare.

Observations indicated that spare tires usually are no better than the worst tire in use on the car. This condition was found to exist among all types of passenger cars, whether used for transporting war workers or for non-essential driving.

In addition to under-inflation, the other chief causes of excessive tire wear were improperly aligned wheels, wheels out of balance, and brakes that were poorly adjusted. All of these incorrect practices cause the rubber tread to disappear fast and unevenly.

In addition to the passenger car tires that were studied, nearly 700 tires on common carrier trucks were observed. Although 73% of the tires continued to show the design of the original tire tread, the treads on 14% of the tires were fast disappearing and the tires were nearly ready for recapping, 10% were worn smooth—just right for recapping, and 3% showed fabric, worn too badly for good recapping.

Tire pressure was checked on more than 300 of the 700 tires on common carrier trucks that were observed. The pressures varied tremendously, and many drivers did not know the proper pressure for the tires on their vehicles. For example, pressures from 40 to 102 pounds were recorded on 9.00 x 20 (12-ply) tires, for which the manufacturers had recommended 80 pounds.

Spare tires not often were neglected on common carrier trucks unless they were located where it was difficult to reach the valve and check the pressure. Many of them, however, were in poor condition and showed wear beyond the point recommended for retreading or recapping. This condition probably existed even before tire rationing became effective.

The truck survey disclosed many cases of faulty wheel alignment, under-inflation, over-inflation, overloading, unbalanced wheels, poorly maintained brakes and cases where nearly all of the braking had been done with the trailer brake without application of the tractor brake.

In one case, a driver had ruined two good front tires by backing a tractor semi-trailer across railroad tracks. Several pounds of rubber were gouged from the tires by the railroad angle irons. Large areas of fabric were left without any rubber.

The information gathered by a tire condition survey will prove to be of considerable value in many ways, such as:

1. To indicate the seriousness of the tire situation at the location under study.
2. For publicity and as a method of making the public conscious of the great need for conservation of tires through careful driving and

the elimination of unessential driving.

3. To convince management at war plants of the need for improving their share-the-ride plan.
4. To inform the state rationing officer of the Office of Price Administration as to the condition of tires on which the war workers must depend for transportation. The state rationing officer in Utah found that his regular allotment of new tires and rubber for recapping for the entire state for three months would be insufficient to meet the present needs of the Utah war workers.

Rufus G. Jasper, author of this article, is Fleet Safety Engineer for the National Safety Council. He has just completed a survey of the condition of automobile tires in the Rock Island-Davenport-Moline area in Illinois and Iowa, on U. S. Highway 41 in Indiana, on U. S. Highway 66 just west of Chicago, in Evanston, Illinois, and in 13 cities and towns in Utah. This article is based on the information gathered in this extensive survey, and is a revision of an article under the same title appearing in the October issue of *Public Safety*.

THE EFFECTIVENESS OF REFLECTORIZED TRAFFIC SIGNS

By

E. P. Davis

Introduction. In the last few years, marked changes and improvements in the materials available for the reflectorization of traffic signs have been made. A search into the literature failed to show that any comprehensive study of the full range of materials now available has been made to evaluate their effectiveness when used in conventional traffic signs.

Sign Effectiveness—It is well recognized that sign effectiveness depends on two main factors—Legibility and Attention Value.

Legibility is a term indicating the ease with which copy can be read under conditions in which there are no distractions. The best practical measure of legibility is the distance at which the sign can be read. Forbes(1) breaks legibility down into pure legibility and glance legibility which he subsequently proves are proportional. Therefore in this study no distinction is made and pure legibility is measured by giving the observer four seconds to read a single four lettered word. It can be assumed that with this reading time no, or at most few errors were made through lack of reading time.

Attention value is a term indicating all those factors which result in attracting the eye to the sign. In this study a comparison is being made of various methods of reflectorizing signs. Therefore such factors as the position, size, and shape are held fixed and the reflectorization factors are the only variables.

Legibility

Procedure and Equipment—In this test a procedure was followed which combined the advantages of the "rapid practical procedure" and the "accurate procedure" as described by Forbes(1).

For night legibility tests the Minnesota State Fair parking lot was chosen as being flat and free of distracting lights. The observers (up to 10) were stationed behind a pair of sealed beam headlights which were mounted in such a position that they corresponded to the headlights of the car in which the observers were riding. The lights were so adjusted individually that they gave maximum brilliance on the signs. Run at seven volts, they delivered 14,000 and

17,000 beam candle power respectively, as measured by a standard Ford headlight tester.

The lighting circuit was so arranged that an automatic timing switch could be thrown on so as to turn the lights on for four seconds for observation purposes and then off for four while the observers wrote down what they had seen, and a new sign was slid in place.

The signs, thirty-six in all, were mounted in an open-sided box in such a manner that they could be slid into view one at a time easily and rapidly. The box was mounted on a small two-wheel automobile trailer so that it could be moved by hand from one station to the next and adjusted to direct the normal of the sign surfaces toward the observers.

At the start of the test, the sign-box was located 500 feet from the observers. The lights were on steady but no signs were visible. In this position, the test was started by throwing on the four second timing switch. While the lights were out, the first test sign was slid into position. It was viewed for four seconds until the lights went off for the second time, and the second sign was slid into place. And so on for all thirty-six signs.

At the end of the run, which took less than five minutes, the sign box was moved to 400 feet and the run repeated. Runs were also made at 350, 300, 250, 200, and 150 feet. At this latter distance all observers could read nearly all the signs so that somewhere in the range 500-150 feet all signs became readable.

The signs were made up of nine various reflecting materials ranging in brilliance per unit area from the standard painted enamel sign, (.20 on an arbitrary brilliance scale) to reflector buttons (200 on this same scale). The other middle brilliance reflectors were such that they split this brilliance range in approximately nine equal steps.

In the sign-box there were four signs made up of each type of reflector. Each sign had four jumbled letters or nonsense words on it, making sixteen letters that the observers were required to read for each type of material. Because some letters are more difficult to read than others, each type of material had the same sixteen letters but they were placed in different orders. Because of the jumbled nature of the words and because the signs were moved from the longer distances to the shorter, there was no opportunity for the observers to anticipate, guess, or remember any of the signs and thus give a false accuracy to the observations.

The readability of a type of material at any one distance was calculated as the percent correct readings of the sixteen letters by all the observers.

The day readability tests were run in the same manner except that the lights were not used. Instead the operator slid a new sign into view every eight seconds.

Results of Night Legibility Test—For the night legibility, thirty observers during four test runs made 7,560 sign observations. The observers ranged in age from 19 to 62 years. The eyesight of the observers seemed to range from very good to very poor. Because no selection of observers was made, it is felt that they were a fairly good cross section of the driving public.

The results are tabulated on Table I. In column 1 is the type of material used as a reflector either in the background or legend as indicated.

In column 2 is indicated the reflective brilliance per unit area of the reflector as measured on a photometer. This brilliance is a relative scale of reflection coefficients of the materials equivalent to that seen by the driver

of an automobile at 150 feet from the signs.

In column 3 is indicated the readability of the materials as measured by the percentage of correct letter readings by all thirty observers. These figures if plotted percent correct readings versus distance at which the readings were made give the readability curves.

Conclusions on Night Readability—Any one table indicates the manner in which readability decreases as the observer distance is increased.

The tables, when compared one with another, show how much more readable one material is than another. For example, it can be seen that white enamel is readable at 230 feet, buttons are readable at 265 feet, or 35 additional feet, and sheet glass is readable at 290 feet or 60 feet further than white enamel.

Experimental silver in turn is readable from 348 feet or 118 feet further than enamel. All the less brilliant sheet reflecting materials are readable at smaller distances than this ranging from 290 to 348 feet and the readability is directly proportional to the reflective brilliance.

The discontinuity of the reflection obtained from buttons tends to make the outlines of letters uncertain and the glare, from excessive brilliance per unit area, bridges over the spacings between letters. In a similar manner sheet glass suffered in readability because the six-inch letters were placed on an eight-inch strip of glass leaving only a one-inch margin of reflective material on the top and bottom to outline the letters.

Results of Day Legibility Tests—The results of a similar readability test using five observers run during daylight conditions are tabulated on Table II. In this table, column 1 indicates the material with which the signs were made and column 2 shows the daylight reflectivity of the material as measured with a Weston Master Exposure Meter under conditions simulating a dull day. Column 3 indicates the readability of the materials by showing the percent of the letters read correctly at the various distances. In column 4 is shown comparatively the readability distance of the various materials as measured by the distance at which 50 per cent of the letters were read correctly.

From this data it can be seen that readability in daylight does not seem to vary a great deal with different materials. The maximum range is from 437 to 502 feet, and there is little or no relationship between readability and reflective brilliance.

In general, all the beaded reflecting materials are slightly more readable, being 50 per cent readable in the range 455 to 502 feet, than white enamel, which is 50 per cent readable at 455 feet. This may be due to the fact that the beaded materials give the effect of a dull finish paint whereas the enamel is a glossy paint.

Attention Value

The attention value of a sign is a term describing the ability of that sign to attract the attention of a driver to it in preference to distractions. These distractions may be other signs on the road, the headlights of on-coming vehicles, a wide variety of obstacles on or beside the road, and even the driver's subconscious thoughts.

Good traffic control signs should have high attention value in order to take preference over distractions. There are many factors such as sign position, size, and shape, all of which affect sign attention value. However, since this is a study of sign reflectorizing materials, only the factor of brilliance or contrast with respect to background has been evaluated in this report.

Method of Test—To show that brilliance is a prime factor in determining

TABLE I

Night Legibility

Material Background	Legend	Reflective Brilliance per Unit Area	500	400	350	300	250	200	150
			Readability % Correct Readings at						
White Enamel	Black Tape	.20	0%	0%	3%	13%	33%	73%	91%
White—Type A	do.	.75	.8	8	21	39	77	96	96
White—Type TC	do.	2.0	2.0	12	37	60	82	93	97
Yellow—Type TC	do.	1.2	.8	11	26	49	76	90	97
Yellow or White—Type S	do.	5.5	2.3	19	42	69	84	94	97
Silver—Type S	do.	12.0	4.0	23	45	69	84	94	97
Silver—Type Exp.	do.	22.0	4.0	23	49	71	89	96	98
Sheet Glass	do.	38-10 Variable	0.0	5	17	45	78	95	98
White Enamel	Black Tape and No. 3A Buttons	200	2	11	21	36	55	77	82

TABLE II

Day Legibility

Material Background	Legend	Daylight Brilliance of Background	500	400	350	300	250	Readability Distance of 50% Correct Readings
			Readability % Correct Readings at					
White Enamel	Black Tape	100%	40%	71%	86%	96%	100%	455
White—Type A	do.	92	46	83	92	96	100	490
White—Type TC	do.	92	50	79	93	100	100	500
Yellow—Type TC	do.	46	45	76	92	95	98	485
White—Type S	do.	60	51	85	96	99	100	502
Silver—Type S	do.	51	29	71	92	96	99	455
Silver—Type Exp.	do.	60	39	85	89	98	100	480
Minolte Glass	do.	100	22	64	84	96	100	437
White Enamel	Black Tape and 3A Buttons	100	32	72	92	100	100	445

TABLE III

Attention Value

Material Background	Legend	Total Sign Brilliance 24" Square	Rank of Four Samples as Tested	Brilliance per Unit Area	Rank in Attention Value
Silver—Type Exp.	Black Tape	100	. .	22	1
Silver—Type S	do.	75	1	12	2
White—Type S	do.	42	2	5.5	3
White Enamel	Black Tape & No. 3A Buttons	38	3	200	4
Sheet Glass 8"x24"	Black Tape	23	. .	25	5
White—Type TC	do.	12	4	2.0	6
Yellow—Type TC	do.	6	. .	1.2	7
White—Type A	do.	4	. .	.75	8
White Enamel	do.	1	. .	.20	9

attention value, the following test was set up. More specifically it was shown that attention value depends on the over all light returned from the whole sign to the observer rather than the reflective brilliance of any small portion of the sign. This last factor is of importance when comparing button signs, which have a relatively small area of high reflective brilliance per unit area, against signs which are reflectorized with a sheet material and have a large area of lower reflective brilliance per unit area.

The equipment used for this attention value test was essentially the same as that used for measuring legibility. But instead of one sign being exposed to view at a time, two were exposed. The observers, stationed behind the light source, were asked in every case to indicate which sign, the right or left, appeared to attract his attention the more.

The signs were located 800 feet from the observer-light source station and the lights were turned on only for ¾ of a second. The time was kept short so that the observers had a chance to evaluate only the attention value and not such factors as eye-appeal or sign type.

There were four types of signs.

On Table III all the materials used in the legibility test are listed. They are listed in order of over-all sign brilliance as measured by a suitable photometer.

Next to the list of materials in Table III is a list of the actual over-all brilliance measurement as measured by the photometer designed for this purpose.

The next column shows rank in attention value as actually measured in the test described above. Note that it agrees with the order shown by "Total Sign Brilliance" in the column to the left, but fails to agree with the order shown in the column "Brilliance Per Unit Area" to the right.

Therefore we can conclude that the rank in attention value, as shown on the column to the right of Table III should be in agreement throughout the whole range with "Total Sign Brilliance" which is a function of the brilliance per unit area times the area which is reflectorized.

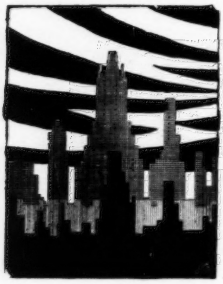
Future Work—A study of this nature is necessarily incomplete. The experiments to date have been run with only one letter size (6″ Series E), and it is logical to assume that different sizes would alter these results. Also, only one light intensity has been evaluated, that of head-lights in the "up" position. Other head-light intensities are of equal importance. We have already run some preliminary tests using an approved "black-out" head lamp. These tests appear to be most interesting and will be reported on as scon as possible.

In addition, these readability tests brought out one point in particular which must be checked, namely, the importance of the type of enamel. On the plain enamel, the button and the sheet glass signs glossy enamel was used, causing considerable specular glare off the surface of the enamel and thus materially altering the legibility characteristics of those particular signs. As soon as possible tests will be run with dull or matte enamel.

Acknowledgements — Gratitude is extended to the members of the Minnesota State Highway Department for their advice and suggestions for making this work a practical evaluation of traffic signs, for their assistance in the construction of "Standard" signs, and for their services in the roll of observers.

(Excerpts from a research study by Edward P. Davis, Chief Physicist, Minnesota Mining & Manufacturing Co., Saint Paul, Minnesota.)

(1) T. W. Forbes, Bureau of Street Traffic Research, Yale University, Journal Applied Psychology. Vol. XXIII, No. 6, pp. 69-684, Dec., 1939.



Stop, Look and Listen

CONGRATULATIONS

Wayne N. Volk (Assoc. I.T.E.), Assistant Traffic Engineer under the late Edward J. O'Meara, was appointed Traffic Engineer by the State Highway Commission of Wisconsin on September 1. Mr. Volk is a 1941 graduate of the Yale Bureau for Street Traffic Research, and had been associated with Mr. O'Meara for eight years. Mr. Volk's qualifications are well known and highly regarded in the field of traffic. Wisconsin will be assured of the same high quality of workmanship given by the late Mr. O'Meara.

Mr. Wallace A. Gove (Assoc. I.T.E.), who has been for some time featuring traffic education with the Worcester Citizen's Safety Commission, was recently selected to serve Worcester, Mass., as Traffic Engineer. Mr. Gove is a graduate of Worcester Polytechnic Institute and the Yale Traffic Bureau. He has served with the Highway Division of the Massachusetts Department of Public Works and the F. B. I. on its recent Police Traffic Training program. Recently Mr. Gove spent six weeks at the Wright Aeronautics Corporation in Paterson, N. J., advising on employee transportation matters.

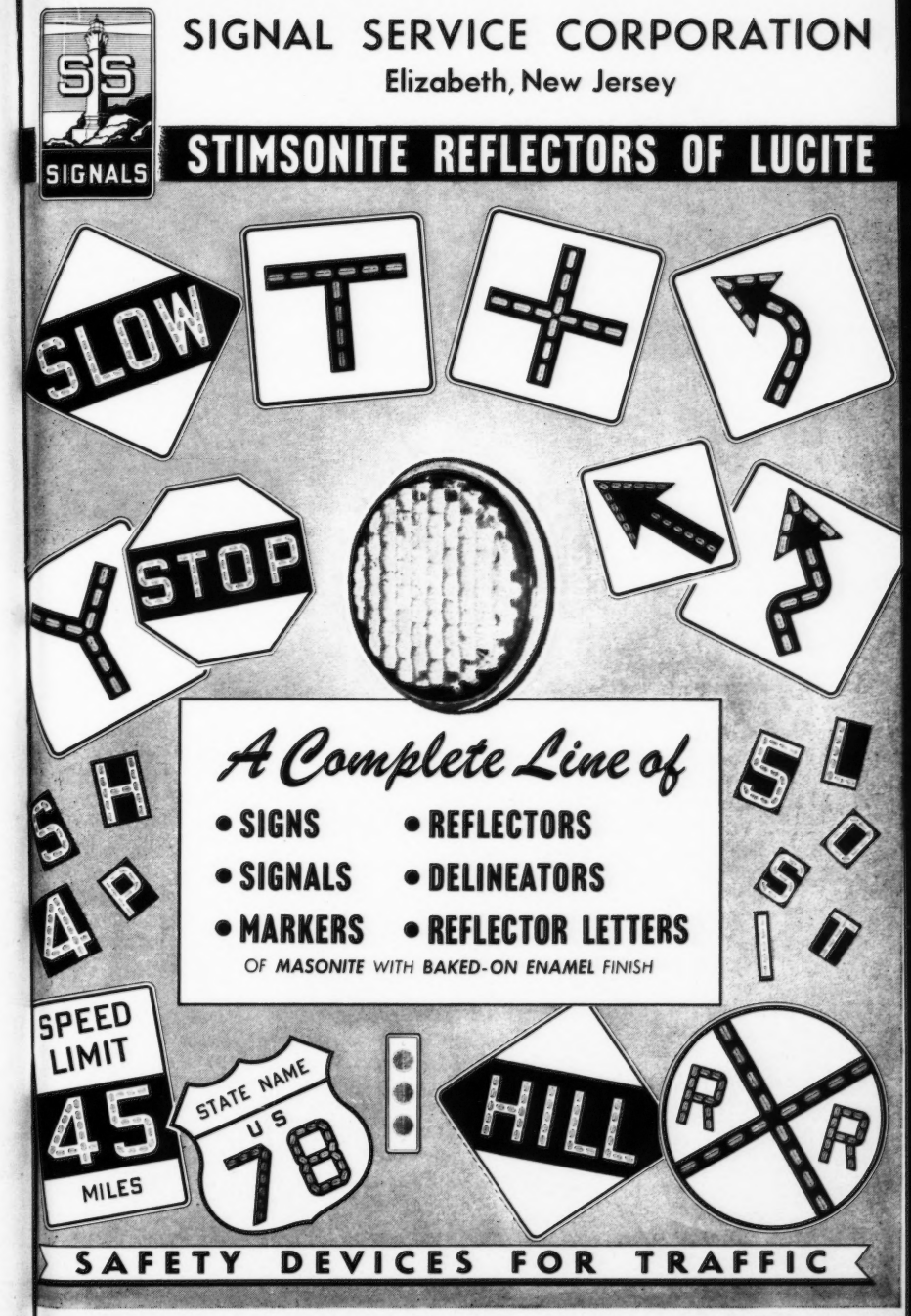
His first act upon becoming Traffic Engineer of Worcester was to eliminate 540 transit stops and increase the length of curb zones for buses. He expects the city's staggered hours program to be in effect in the near future.

YOUNG MAN REVERSES TREND; GOES EAST

Charles H. Rex (Mem. I.T.E.), having been requisitioned by the Design Engineering Department, Lighting Division, of the General Electric Company began his new duties at the Lynn (Massachusetts) plant on October 1, 1942. Charlie said au revoir to the Chicago office of the same company where he has been Special Representative on street and highway lighting since the inception of modern safety lighting. He found it necessary to leave his family, including a 12-day old son, in Wilmette until suitable quarters can be found at the new location.

LT. W. R. ABBOTT, JR. HITS THE DECK

W. R. Abbott, Jr. (Assoc. I.T.E.), formerly Division Manager of the Automatic Signal Corporation in Chicago, has been commissioned Lieutenant in the Air Volunteers, U.S.N.R. Lt. Abbott left Chicago October 12 for Quonset, Rhode Island, where he will spend a probationary period of eight weeks in training at the U. S. Naval Station. Lt. Abbott is an associate member of the Institute of Traffic Engineers and had several responsibilities in connection with the forthcoming convention which have been assigned to the boys he left behind. The Automatic Signal Corporation plans to maintain an office in Chicago during Lt. Abbott's leave of absence.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SAFETY DEVICES FOR TRAFFIC

IT'S CAPTAINS HARRISON AND FRITTS NOW

During our Annual Meeting Harry H. Harrison, a member and a member of the Board of Direction of the Institute, and Carl E. Fritts, an Associate Member of the Institute, received their appointments and orders as Captains in the Transport Corps, Service of Supply of the United States Army. Captain Harrison has taken a leave of absence from the Illinois Division of Highways after 23 years of service, nine of them as State Traffic Engineer. Captain Fritts was formerly Traffic Engineer, Washington State Highway Dept., Olympia, Washington. Both of the newly appointed captains have recently been engaged in outstanding war and civil protection activities. The Institute wishes them the best of luck.

MORE STAGGERED HOURS

E. A. Roberts, Associate Director of the Local Transport Division of ODT, told some 300 members of the New England Transit Club in Providence on November 6, 1942, to urge "short haul passengers to walk."

Mr. Roberts said that transit companies "cannot count on new equipment but you can count on greater and greater traffic" and transit companies must also "encourage private car owners to fill up their back seats with *your* passengers." He also went on to add that staggered hours cannot be emphasized too much and while much has been done to smooth out the peaks, we must go further and build up the valleys.

TRAFFIC DEATHS CUT

The National Safety Council announced recently that the nine-month fatality total for this was 21,290 against 27,900 for the same period in 1941. The Council attributed the drop to gasoline and tire rationing.

CHANGE OF ADDRESS

The future business address of I. S. Shattuck (Mem. I.T.E.) is: National Housing Agency, Office of the Administrator, 1600 Eye St., N. W., Washington, D. C.

WELCOME AND CONGRATULATIONS

The membership is happy to announce the following new members and transfers in I. T. E. elected at Board meeting October 25, 1942:

Admitted as Members

Fowler, Fred T.
Keeley, A. E.
Waterbury, Lawrence S.
Weller, William J.
Wilson, Richard A.

Admitted as Associate

Bebee, Maynard A.
Eckhardt, Harold G.
Erickson, Elroy E.
Fisher, Geo. J.
Gove, A. Wallace
Harger, Ross C.
Harrison, Russell E.
Myers, Dwight T.
Stancer, William A.
Taylor, Earl W.
Walbert, Thomas P.
Webb, George M.

Admitted as Juniors

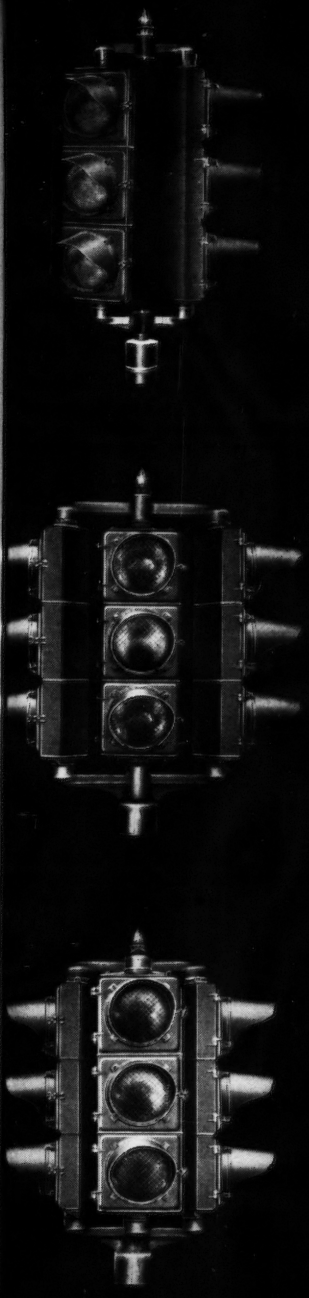
Bevins, Karl A.
Conroy, Allan T.
Howie, George B., Jr.
McGillivray, Ronald K.
Shuttleworth, Gerald E.
Smoot, A. Glen

Transfer to Member

Greenshields, Bruce D.
Osborne, Henry W.
Rittgers, Virden A.
Willier, Thomas E.

Transfer to Associate

Sielski, Matthew C.
Hartung, Bernard C.
Baldwin, David M.
Howard, Harry, Jr.



TRAFFIC SIGNALS YOU'LL BE PROUD TO INSTALL

PROUD! Because you have accomplished something really fine — an installation of signals that you can point to with pride and feel good and glad because it's your work. Sturdy and attractive Marbelite Signals! Better Built quality that you will find difficult to match anywhere. And how you will appreciate those aluminum mounting brackets which replace the troublesome pipe fittings assembly—brackets which make the signal so much more compact!

It's no wonder that so many of the large Municipal and State Highway Traffic Departments are installing hundreds of Marbelite Signals. These Better Built Signals are bound to win the preference. Write today for a descriptive folder, and request quotations on the type signals you would like to install.

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WANTED SECRETARY-DIRECTOR

The Civil Service Board of the City of Portland, Oregon, is seeking qualified applicants for the position of Secretary-Director of the Traffic Safety Commission. Minimum salary for this position is $3,000 per year, maximum is $3,600, plus the $5.40 per month cost of living adjustment.

The following requirements must be fulfilled by the applicant:

1. Citizen of the United States.
2. High school or business school graduate.
3. Good health. No disabling defects.
4. Experience (within the last 7 years): Either
   a. Two years full time paid experience as responsible executive in charge of traffic safety program for a state or for a city or county having a population of 100,000 or over. Or
   b. Four years full time paid experience as responsible executive of an advertising firm, or a chamber of commerce, or a civic organization engaged in developing a community program, or in charge of public relations and/or publicity of a large business firm or institution. Or
   c. Four years full time paid experience as traffic engineer, law enforcement officer in charge of a traffic safety program, director of a traffic school, public relations counsel, or safety engineer in charge of a large business safety program. Or
   d. Some equivalent combination of similar kinds of experience.

NOTE—Two years of satisfactory work toward a college degree may be substituted for one year of required experience.

The six applicants receiving the highest rating on the foregoing qualifications will be called for an interview. Application blanks may be obtained from the office of the Civil Service Board, 103 City Hall, Portland, Oregon. Last day for filing applications is Saturday, December 5, 1942, before 12:00 o'clock noon.

ANNUAL MEETING HIGHWAY RESEARCH BOARD

Mr. Roy B. Crum, Director of the Highway Research Board, has extended a cordial invitation to all members of the Institute of Traffic Engineers to attend the Board's Twenty-second Annual Meeting to be held in the Hotel Statler, St. Louis, Missouri, from December 1-4, 1942. Of timely interest to Traffic Engineers, from an up-to-the-minute program, are the sessions on Wednesday and Thursday mornings, December 3rd and 4th. On Wednesday Traffic Control Devices, Recent Trends in Speeds, Wartime Changes in Traffic, Highway Network, Flight Strips, etc., will be discussed. On Thursday Motor Vehicle Operating Costs, Maximum Tire Mileage Possibilities, and other important economic factors will be set forth.

The Traffic Engineer's participation and leadership in traffic research will assure the attendance of many, despite the added burden upon traffic engineers resulting from wartime conditions.

We are sure that Joseph T. Feuchter (Mem. I.T.E.) and Traffic Engineer of St. Louis will act as host to visiting members of the Institute of Traffic Engineers.

SUBSCRIPTION PRICE TRAFFIC ENGINEERING

The Board of Direction in session at the 13th Annual Meeting in Chicago voted to set the price of TRAFFIC ENGINEERING, beginning with the November issue at 15c a single copy and $1.50 for a year's subscription to nonmembers of the Institute of Traffic Engineers.